

CLAIMS

1. A synchronization method for data demodulation in an OFDM
5 radio receiver, comprising the steps of:

sampling and measuring an OFDM radio transmission to obtain a series of received-signal samples that represent a short preamble, a long preamble guard interval (GI), and a first long preamble, respectively;

10 computing an inner product of vectors comprised of samples $x(n)$, $x(n-1)$, ..., $x(n-1-N)$ and $x(n)$, $x(n+1)$, ..., $x(n+N)$ and computing the magnitude squared;

to exploit the periodicity of the long-preamble, coherent (and non-coherent) combining is performed as follows:

$$y(n) = \left\| \sum_{k=0}^{N-1} \{x(n-k) + x(n-k+64)\} \{x(n+k) + x(n+k+64)\} + \sum_{k=0}^{N-1} x(n+32-k)x(n+32+k) \right\|^2$$

15 assuming an index of the maximum of the result is the index of the start of the first long preamble;

subtracting a corresponding number of samples to find a first received-signal sample of said long preamble guard interval (GI); and

20 identifying said first sample of said long preamble GI to synchronize any data demodulation of subsequent parts of said OFDM radio transmission.

2. A synchronization method for data demodulation in an OFDM radio
25 receiver, comprising the steps of:

computing includes constraining the reference signal so as to make it insensitive to timing misalignment;

computing includes constraining the reference signal so as to make it insensitive to frequency offset;

30 computing a reference signal that is insensitive to any other parametrizable impairment;

computing an inner product between the received signal and this constrained reference signal; and

assuming an index of the maximum of the result is the index of the start of the long preamble sequence.

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3. A synchronization method for data demodulation in an OFDM radio receiver, comprising the steps of:

sampling and measuring an OFDM radio transmission to obtain a series of received-signal samples that represent a short preamble, a long preamble guard interval (GI), and a first long preamble, respectively;

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massaging of the samples around $x(n+32)$ can be performed so as to achieve a “coherent” copy of the samples around $x(n)$ and $x(n+64)$

$$\bar{z}_B = [-x(n+32) \quad \text{flipud}(\text{conj}(x(n+32-1:-1:n+32-N))))]$$

$$\bar{z}_F = [-x(n+32) \quad \text{flipud}(\text{conj}(x(n+32+1:1:n+32+N))))]$$

$$y(n) = \left\| \sum_{k=0}^{N-1} \{x(n-k) + x(n-k+64) + \bar{z}_B(k)\} \{x(n+k) + x(n+k+64) + \bar{z}_F(n)\} \right\|^2$$

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assuming an index of the maximum of the result is the index of the start of the first long preamble;

subtracting a corresponding number of samples to find a first received-signal sample of said long preamble guard interval (GI); and

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identifying said first sample of said long preamble GI to synchronize any data demodulation of subsequent parts of said OFDM radio transmission.

4. A synchronization method for data demodulation in an OFDM radio receiver, comprising the steps of:

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sampling and measuring an OFDM radio transmission to obtain a series of received-signal samples that represent a short preamble, a long preamble guard interval (GI), and a first long preamble, respectively;

the vector inner products (complex) result) of the previous and subsequent samples starting at $x(n)$ and $x(n+32)$ are added and then collect the sample at $x(n+64+32)$

$$y(n) = \left\| \sum_{k=0}^{N-1} x(n-k)x(n+k) + \sum_{k=0}^{N-1} x(n+32-k)x(n+32+k) \right\|^2$$

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assuming an index of the maximum of the result is the index of the start of the first long preamble;

subtracting a corresponding number of samples to find a first received-signal sample of said long preamble guard interval (GI); and

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identifying said first sample of said long preamble GI to synchronize any data demodulation of subsequent parts of said OFDM radio transmission.

5. A synchronization method for data demodulation in an OFDM radio receiver, comprising the steps of:

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exploiting a specific structure in long-preamble, let $x(0)$ be the first sample of the long-preamble, in the absence of signal impairments, the sequence of points, $x(16)$, $x(32)$, $x(48)$, $x(64)$, $x(80)$, $x(96)$ exhibits a unique relative phase transversal, in the absence of signal impairments, the absolute phase of this sequence is $\pi/4, 0, -\pi/4, -\pi, \pi/4, 0$. relative phases will be $0, -\pi/4, -\pi/2, -5\pi/4, 0, -\pi/4$;

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wherein both the short- and long preambles, no other set of six samples separated by 16 samples exhibits this relative transversal.